Findings of Fact
for
Best Available Control Technology
Determination
for
Control of Nitrogen Oxides
for
M.R. Young Station
Units 1 and 2

November, 2010

ND Department of Health
Division of Air Quality
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The North Dakota Department of Health (Department) makes this BACT Determination for M.R. Young Station Units 1 and 2 (MRYS) pursuant to the provisions of a Consent Decree entered by the United States District Court for the District of North Dakota for Civil Action No. 1:06-CV-034, United States of America and the State of North Dakota versus Minnkota Power Cooperative, Inc. and Square Butte Electric Cooperative.

Having considered the comments made and other information entered into the record, and hereby incorporating its two Preliminary Determinations and its Responses to Comments in these proceedings, the Department makes the following **Findings and Conclusions:**

I. Introduction

A. Background

Minnkota Power Cooperative (Minnkota) operates the MRYS near Center, North Dakota. Unit 1 of the station is owned by Minnkota Power Cooperative and has a gross rating of approximately 257 MWe. Existing air pollution controls on Unit 1 consist of a cold-side electrostatic precipitator. Unit 2, which is owned by Square Butte Electric Cooperative, has a rating of approximately 477 MWe gross. Existing air pollution controls on Unit 2 consist of a cold-side electrostatic precipitator and a lime/flyash wet scrubber for sulfur dioxide control. Unit 1 went online in 1970 while Unit 2 began operations in 1977. Both units are fired on lignite obtained from BNI Coal Ltd's Center Mine which is adjacent to the station.

The United States of America – on behalf of the Environmental Protection Agency (EPA) – and the State of North Dakota filed a Complaint alleging, among other things, that Minnkota had failed to obtain the necessary permits and install the controls necessary under the Clean Air Act to reduce its nitrogen oxide (NO_x) emissions. The parties entered into a Consent Decree to settle the alleged violations, which was approved and entered by the court on July 27, 2006. Under the terms of the Consent Decree, the Department must make a NO_x Best Available Control Technology Determination (BACT Determination) for both units at MRYS.

B. Consent Decree's Requirements for NO_x BACT Analysis and Determination

The Consent Decree requires Minnkota to submit to the Department for review and approval a NO_x Top-Down Best Available Control Technology Analysis (BACT Analysis) for the two existing units at MRYS. Minnkota must complete its BACT Analysis in accordance with the provisions of Chapter B of EPA's "New Source Review Workshop Manual – Prevention of Significant Deterioration and Nonattainment Area Permitting," (Draft October 1990) ("NSR Manual")[1]. The Consent Decree lists the technologies Minnkota must evaluate as part of its BACT Analysis, including selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), over-fire air (OFA), and rich reagent injection (RRI). The BACT Analysis must address both a normal operating scenario and a startup scenario, specify the technology to be installed, and recommend an emission rate on 30-day rolling average basis, that is BACT for each of the units and for each scenario evaluated. Throughout the process Minnkota is required to submit any additional, pertinent information requested by the Department or the EPA.

After Minnkota completes its BACT Analysis, the Department must review the BACT Analysis and develop a BACT Determination in compliance with applicable federal and state statutes, rules and guidance. In making its BACT Determination, the Department must consult with EPA. The BACT Determination must include for each unit the specific control technologies to be installed and a specific Phase II 30-Day Rolling Average NO_x Emission Rate limitation (lbs/MMBtu).

C. History of BACT Analysis and Determination

On October 9, 2006, the Department received Minnkota's BACT Analysis and concluded that Minnkota had included all of the items required by the Consent Decree.

In June 2008, the Department provided for public comment a Preliminary BACT Determination that SCR, including high dust SCR (HDSCR), low dust SCR (LDSCR), and tail-end SCR (TESCR), was not technically feasible for the MRYS[10]. Based on the comments received during that public comment period, the Department reconsidered the technical feasibility of LDSCR and TESCR[2].

In November 2008, the Department confirmed that HDSCR was not technically feasible; however, it determined that LDSCR and TESCR had a good possibility of successful operation. Based on this determination, the Department asked Minnkota to prepare a cost estimate and complete the BACT Analysis for LDSCR and TESCR. This analysis was submitted in November 2009 and was revised in February 2010.

In April 2010, the Department provided for public comment a second Preliminary BACT Determination[11] that confirmed that SCR (HDSCR, LDSCR, and TESCR) was not BACT for MRYS. In its second Preliminary BACT Determination, the Department reconfirmed that HDSCR was not technically feasible and that there were serious concerns about the technical feasibility of LDSCR and TESCR. Since the Department's November 2008 conclusion that LDSCR and TESCR are technically feasible, additional information has been obtained that contradicts that conclusion. First, the Department learned that, contrary to earlier information provided to the Department, Haldor Topsoe, Incorporated (HTI) and CERAM Environmental, Incorporated (CERAM), both potential vendors for SCR catalyst, would not provide a catalyst life guarantee for LDSCR or TESCR. Second, HTI and CERAM both indicated that an SCR designer must look at the full range of flue gas characteristics. Catalyst deactivation can occur rapidly, so worst case flue gas characteristics are important and must be evaluated. The Department's 2008 analysis only evaluated one concentration of sodium and potassium in the flue gas. This concentration did not account for worst case conditions. Third, the vendors indicated that the flue gas characteristics may be worse than the biomass boilers the Department evaluated where TESCR has been applied.

II. Overview of Applicable Law

A. Definition of Best Available Control Technology

An emissions limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under the Clean Air Act which would be emitted from any proposed major stationary source or major modification which the Department, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60 and 61. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results. N.D. Admin. Code § 33-15-15-01.2

B. Steps for Conducting a BACT Analysis Using the "Top-Down" Approach

- **Step 1: Identify All Control Technologies**

- **List is comprehensive**

All "available" control technologies must be listed in Step 1. For purposes of Step 1, "available" means "those air pollution control technologies or techniques with a practical potential for application to the emissions unit and the regulated pollutant under evaluation." (Section III.A page B.5).

Potentially applicable control technologies are divided into three categories:

- *Inherently Lower-Emitting Processes/Practices*, including the use of materials and production processes and work practices that prevent emissions and result in lower "production-specific" emissions; and

- *Add-on Controls*, such as scrubbers, fabric filters, thermal oxidizers and other devices that control and reduce emissions after they are produced.

- *Combinations of Inherently Lower Emitting Processes and Add-on Controls*. For example, the application of combustion and post-combustion controls to reduce NO_x emissions at a gas-fired turbine. (Section IV.A page B.10)

A proper BACT analysis requires consideration of "potentially applicable control techniques from all three categories." Unlike other types of control technologies, add-on controls "should be considered based on the physical and chemical characteristics of the pollutant-bearing emission stream." Accordingly, "candidate add-on controls may have been applied to a broad range of emission unit types that are similar, insofar as emissions characteristics, to the emissions unit undergoing BACT review." (Section IV.A page B.10).

- **Step 2: Eliminate Technically Infeasible Options**

  - A demonstration of technical infeasibility should be clearly documented and should show, based on physical, chemical, and engineering principles, that technical difficulties would preclude the successful use of the control option on the emissions unit under review.

    In Step 2, "technically infeasible" options are eliminated from the list created in Step 1. The NSR Manual[1] provides guidance for determining whether a control option is technically feasible. Control options that are "demonstrated" – or "installed and operated successfully on the type of source under review" – are technically feasible. To be technically feasible, an undemonstrated control technology must be both "available" and "applicable." A technology is considered "available" if it can be acquired "through commercial channels or is otherwise available within the common sense meaning of the term." An available technology is "applicable" if the technology "can reasonably be installed and operated on the source type under consideration." (Section IV.B. page B.17).

    Regarding "availability" the NSR Manual[1] states:

    A control technique is considered available, within the context presented above, if it has reached the licensing and commercial sales stage of development. A source would not be required to experience extended time delays or resource penalties to allow research to be conducted on a new technique. Neither is it expected that an applicant would be required to experience extended trials to learn how to apply a technology on a totally new and dissimilar source type. Consequently, technologies in a pilot scale testing stages of development would not be considered available for BACT review. (Section IV.B page B.18)

    With respect to "applicability" the NSR Manual[1] states:

    Technical judgment on the part of the applicant and the review authority is to be exercised in determining whether a control alternative is applicable to the source type under consideration. In general, a commercially available control option will be presumed applicable if it has been or is soon to be deployed (e.g., is specified in a permit) on the same or a similar source type. Absent a showing of this type, technical feasibility would be based on examination of the physical and chemical characteristics of the pollutant-bearing gas stream and comparison to the gas stream characteristics of the source types to which the technology had been applied previously. Deployment of the control technology on an existing source with similar gas stream characteristics is generally sufficient basis for concluding technical feasibility barring a demonstration to the contrary. (Section IV.B page B.18-19)

The NSR Manual[1] further notes that:

In practice, decisions about technical feasibility are within the purview of the review authority. Further, a presumption of technical feasibility may be made by the review authority based solely on technology transfer. For example, in the case of add-on controls, decisions of this type would be made by comparing the physical and chemical characteristics of the exhaust gas stream from the unit under review to those of the unit from which the technology is to be transferred. Unless significant differences between source types exist that are pertinent to the successful operation of the control device, the control option is presumed to be technically feasible unless the source can present information to the contrary. (Section IV.B page B.19)

- **Step 3: Rank Remaining Control Technologies By Control Effectiveness**

  Should include:

  - control effectiveness (percent pollutant removed);
  - expected emission rate (tons per year);
  - expected emission reduction (tons per year);
  - energy impacts (Btu, kW-hr);
  - environmental impacts (other media and the emissions of toxic and hazardous air emissions); and
  - economic impacts (total cost effectiveness and incremental cost effectiveness).

- **Step 4: Evaluate Most Effective Controls and Document Results**

  - Case-by-case consideration of energy, environmental, and economic impacts.
  - If most effective option is not selected as BACT, evaluate next most effective control option.

- **Step 5: Select BACT**

  - Most effective option not rejected is BACT and establish emission limit or work practice standard.

III. Determination on SCR

The following discussion is applicable to both units at MRYS, due to the similarities between them. This document focuses on the technical feasibility – specifically, the availability and applicability – of SCR (including HDSCR, LDSCR, and TESCR) and the cost effectiveness of those control technologies. These are the issues that have been raised by the parties to the Consent Decree and in the public comments. For other aspects of the BACT Determination, the Department relies on its 2008 Preliminary BACT Determination and its response to comments received on that document, which are incorporated herein by reference.

A. Technical Feasibility of LDSCR and TESCR for MRYS

LDSCR and TESCR are evaluated together since the flue gas characteristics at each location would not vary significantly and both vendors from which Minnkota had sought proposals (HTI and CERAM) indicated they would not provide a guarantee for either location. With regard to the technical feasibility of these control technologies, the Department makes the following findings and conclusions:

1. There has never been a full scale SCR – of any type – installed on a facility that burns North Dakota lignite.

2. To determine technical feasibility of LDSCR and TESCR, one must compare the flue gas characteristics of MRYS to the flue gas characteristics of other source types to which these control technologies have been applied previously.

3. The lignite combusted at MRYS contains high quantities of soluble sodium and potassium which can cause catalyst reaction site poisoning, blinding, and plugging of catalyst pores and channels. Core samples for 2007-2010 indicated a sodium oxide (Na_2O) concentration in the ash as high as 13.4% and a potassium oxide (K_2O) concentration as high as 6.9% (Appendix A-2, 4/23/07 submittal). During combustion of this fuel in the cyclone furnaces at MRYS, a significant portion of these organically associated elements are either vaporized or form small particles that leave the boiler in the flue gas. Soluble sodium and potassium are catalyst poisons even in dry conditions in the SCR[3]. The soluble sodium and potassium can also form sulfates that can blind and plug the catalyst pores and plug the catalyst channels.

4. The flue gas characteristics of MRYS are significantly different from other boilers where SCR has been applied. The high soluble sodium content (catalyst poison) and the sticky nature of the ash are characteristics that are different from facilities where SCR has been successfully applied. Minnkota has supplied a significant amount of material that clearly shows the difference.

5. CERAM stated it is unaware of any SCR application experience in the industry with the level and form of sodium in the ash at MRYS. In its proposal[3] to Minnkota, CERAM stated that, "The high levels of Na_2O in the ash for the North Dakota lignite are not commonly found in sub-bituminous and bituminous coals which are fired with SCR systems." CERAM[3] also stated, "The levels of K_20 in the North Dakota lignite ash are in the high end range found in

many biomass fuels, such as wood and switch grass. However, the levels of Na_2O are much greater than that found in biomass or coal-fired SCR applications."

6. HTI[4] stated, "… the potential exists that physical deactivation due to catalyst blinding and plugging could be severe enough to make SCR a non-viable option for controlling NO_x emissions."

7. Regarding North Dakota lignite, Sargent and Lundy (S&L) stated, "There are attributes of this fuel in a tail-end SCR environment that are not well understood today and need more investigation to predict its performance to make it a commercially available technology." S&L also stated, "Some important unanswered questions pose a significant risk for an SCR design engineer for tail-end SCR[9]."

8. The State of Louisiana determined that SCR was not feasible for the Red River Environmental Products, LLC, activated carbon plant that uses lignite[8]. This determination was based on a finding that the sodium sulfate in the flue gas could cause rapid deactivation of the catalyst and the lack of operating or empirical data.

9. EPA has considered cyclone (and more generally slag tap) furnaces that burn lignite from North Dakota, South Dakota, and Montana to be a separate source category for NO_x emission limits in 40 CFR 60 Subparts D and Da. This was due to the high sodium content of the lignite (43 FR 9276). Not until EPA established a fuel and furnace type neutral standard was all subcategorization eliminated.

10. In its justification for the fuel and furnace type neutral standard, EPA determined that "there is considerable experience in the industry to show that use of SCR on lignite is technically feasible." To support this determination, EPA stated that SCR was shown to work on Gulf Coast lignite, Texas lignite, and European brown coals, and that performance guarantees can be obtained from catalyst suppliers (71 FR 9870). The Department does not find EPA's justification for the fuel and furnace type neutral standard persuasive to show that SCR is technically feasible at MRYS and disagrees with EPA's statements made in that justification. First, the Department believes that there is <u>not</u> considerable experience in the industry to show the use of SCR for a North Dakota lignite-fired unit is technically feasible. CERAM has stated "CERAM is unaware of any SCR application experience in the industry with this level and form of sodium in the ash." Second, Minnkota has clearly demonstrated that the ash from MRYS is different from Gulf Coast lignite, Texas lignite and European brown coals where SCR has been applied. CERAM and HTI both have indicated that they have offered catalyst life guarantees for other lignite fired units, including Texas lignite; however, they have refused to provide a catalyst life guarantee for MRYS which burns North Dakota lignite. In addition, it is not clear what criteria EPA used to determine that SCR was technically feasible for NSPS purposes or the BART Guidelines. Under the PSD program, technical feasibility determinations are based on the flue gas characteristics of the source evaluated. The Department is not aware of any analysis of the flue gas characteristics of North Dakota lignite by EPA which was considered when the subpart Da standards were revised or the BART Guidelines were developed.

11. Both HTI and CERAM indicated in their October 2009 proposals they will not provide a guarantee for the catalyst life without successful pilot scale testing being done. HTI indicated that SCR may not be a viable option for MRYS and that pilot testing would be necessary to show whether SCR is a viable option. S&L also recommended that pilot testing be conducted to answer questions about the effects of the soluble alkalis and ash characteristics including the size, stickiness and abrasiveness qualities of the ash. An SCR that is guaranteed to work successfully is not available for MRYS.

12. Both HTI and CERAM indicated that refusal to provide a catalyst guarantee is extremely rare. They both indicated they have offered guarantees for other types of lignite (including Texas lignite), European brown coals, and biomass. Both companies indicated they were not aware of any SCR being installed in the United States without a catalyst life guarantee.

13. In a letter to Burns and McDonnell (July 27, 2010), HTI stated:

"HTI currently has one of the first SCR's on a unit firing Texas lignite, where HTI provided a full 3 year catalyst life guarantee along with typical NO_x removal effects, ammonia slip, SO_2 oxidation rates, and pressure drop guarantees. Performance of this SCR has been excellent since start-up. HTI also has the majority of the biomass fired applications in the U.S. and the majority of the IGCC applications in the world. All of these are new and very challenging projects which push the technology to the next level.

HTI does not avoid challenging applications, but we do review the technical as well as financial risks associated with each project. If the risk level is too high then we may choose not to participate in the project or only provide catalyst without performance guarantees."

14. EPA has indicated that BACT is intended as a "technology forcing" requirement. HTI has indicated they have "forced" the technology (SCR) at other facilities and provided guarantees. Apparently, the use of SCR at MRYS forces the technology beyond an acceptable risk for the company. The same is apparently true for CERAM. Both companies have indicated that their decision not to provide a guarantee was not influenced by Minnkota or Burns and McDonnell. It was a business decision based on the risk involved.

15. The Department of Justice, through its contractor Evonik Energy Services, LLL (Evonik) provided a Request for Proposals (RFP) to HTI and CERAM supposedly based on the flue gas characteristics of MRYS. Both companies indicated they would provide catalyst life guarantees to Evonik based on the RFP. HTI and CERAM have provided letters explaining this seeming contradiction. Both have indicated that Evonik did not provide a fuel analysis, ash analyses, the range of fuel and ash characteristics that could be encountered, details on the soluble constituents in the flue gas and the fact that it was North Dakota lignite. HTI believed the RFP was for a facility burning eastern subbituminous coal. HTI indicated they would not have provided a guarantee if it had known that the fuel was North Dakota lignite. CERAM has indicated it would not have provided a guarantee if the Evonik RFP had provided the same level of detail as the Minnkota RFP. The RFP by Evonik and subsequent proposals by CERAM and HTI proved nothing and have no value.

16. CERAM and HTI have indicated that up to one year of pilot scale testing is required before they would consider a guarantee. This is consistent with S&L's recommendation of one year of operation of a pilot scale test. S&L indicated that the overall pilot scale test program duration would be 18-24 months based on one year of operation. The additional time is for design, mobilization, setup and evaluation of the data.

17. Estimates of the cost of pilot scale testing range up to two million dollars.[9]

18. MRYS, and cyclone boilers burning North Dakota lignite, is a new and dissimilar source category from other sources that have successfully applied SCR.

19. Minnkota is not required under BACT to assume the high risk associated with the failure of a technology that has never been used on a North Dakota lignite-fired unit or source with similar flue gas characteristics.

20. Minnkota is not required to experience resource penalties or extended trials to learn how to apply SCR to MRYS – a new and dissimilar source type.

21. LDSCR and TESCR for MRYS are in the pilot stage of development. Technologies in the pilot scale testing phase of development need not be considered as available control technologies.

22. Based on the lack of vendor guarantees and need for pilot testing, LDSCR and TESCR for MRYS cannot be obtained through commercial channels and is not otherwise available within the common sense meaning of the word. Thus, LDSCR and TESCR for MRYS are not "available" for purposes of Step 2 of the BACT Analysis.

23. LDSCR and TESCR have not been, and will not soon be, deployed on the same or a similar source. MRYS's flue gas characteristics are significantly different from other sources that have applied LDSCR and TESCR and these unique characteristics present significant challenges to successful application of those control technologies for MRYS. Thus, LDSCR and TESCR cannot reasonably be installed at MRYS and are therefore not "applicable" for MRYS for purposes of Step 2 of the BACT Analysis.

24. Because LDSCR and TESCR are neither "available" nor "applicable" to MRYS, these control technologies are technically infeasible for MRYS.

B. Technical Feasibility of HDSCR

With regard to the technical feasibility of these control technologies, the Department makes the following findings and conclusions:

1. In the November 2008 technical feasibility analysis[2], the Department evaluated HDSCR and determined it was not technically feasible. This was consistent with the Department's June 2008 Preliminary BACT Determination[10].

2. Microbeam Technologies, Inc. (Microbeam) conducted particulate emissions testing at MRYS in March of 2009. The results indicate that most of the particulate matter emissions from each boiler are removed by the electrostatic precipitator (ESP). Microbeam's results indicated a particulate matter removal efficiency of 99.76%. Microbeam's results also indicate the amount of $Na_2O + K_2O$ is approximately 50-90 times greater entering the ESP than exiting the ESP. The results are similar for $Na_2O + K_2O$ entering the ESP versus exiting the wet scrubber. Because a HDSCR will be placed before the ESP, the loading of $Na_2O + K_2O$ on a HDSCR would be approximately 50-90 times higher than a LDSCR or TESCR.

3. The Department has reviewed the Microbeam Technologies report[5] and reached the same conclusions regarding technical feasibility. The empirical data shows a very strong indication that HDSCR will not achieve a successful catalyst life. The amount of sodium and potassium in the flue gas is so high that it is very unlikely that 10,000 hours of catalyst life could be achieved. The testing by Kling[6] found deactivation rates up to 52% in 1500 hours for a fuel made up of tree bark and 30% demolition waste. The Microbeam[5] results suggest a similar rate for MRYS. Zheng[7] found a deactivation rate of 0.4% per day using 20-30 mg/Nm^3 of potassium sulfate with a mass mean diameter of 0.55 micrometers. The 0.4% deactivation rate per day is equivalent to 6000 hours to 100% deactivation. The Microbeam[5] results indicate a higher potassium sulfate equivalent loading of aerosols less than 0.55 µm at MRYS. Both HTI and CERAM indicated change out of the SCR catalyst at 50% deactivation, not 100% deactivation.

4. The flue gas temperature problems associated with HDSCR still remain. The temperature problem is another potential fatal flaw to the successful use of HDSCR at MRYS. An extensive engineering study must be conducted to determine if this problem can be resolved. Babcock and Wilcox estimated the cost of the study at $275,000-$400,000 and would take 20-24 weeks to complete.

5. Minnkota was unable to get a catalyst life guarantee for LDSCR and TESCR. It is very unlikely that a guarantee would be offered for HDSCR when the loading of catalyst deactivation compounds is 50-90 times higher than LDSCR or TESCR.

6. In 2007, Minnkota solicited information from SCR and catalyst vendors. Although some vendor responses indicated a high degree of confidence about the successful use of HDSCR at MRYS, all vendor responses indicated the need for pilot scale testing to determine if there were fatal flaws for using HDSCR. Two of the companies that expressed confidence in the use of HDSCR at MRYS were HTI and CERAM. Each company has since refused to offer a catalyst life guarantee for LDSCR or TESCR. It appears a catalyst life guarantee for HDSCR cannot be obtained.

7. As discussed in Subsection III(A), SCR – including HDSCR – has not been applied to a ND lignite-fired unit or a source with similar flue gas characteristics to MRYS. MRYS is a new and dissimilar source type category from other sources that have successfully applied SCR.

8. Minnkota is not required to undergo the expensive and lengthy time delays that would be required in order to learn how to apply HDSCR technology to MRYS – a new and dissimilar source type.

9. HDSCR for MRYS is in the pilot stage of development. Technologies in the pilot scale testing phase of development need not be considered as available control technologies.

10. Based on the lack of vendor guarantees and need for pilot testing, HDSCR for MRYS cannot be obtained through commercial channels and is not otherwise available within the common sense meaning of the word. Thus, HDSCR for MRYS is not “available” for purposes of Step 2 of the BACT Analysis.

11. HDSCR has not been, and will not soon be, deployed on the same or a similar source. MRYS’s flue gas characteristics are significantly different from other sources that have applied HDSCR and these unique characteristics present significant challenges to successful application of this control technology for MRYS. In addition, the flue gas temperature problem may not be solvable (a complex study is required). Thus, HDSCR cannot reasonably be installed at MRYS and is therefore not “applicable” for MRYS for purposes of Step 2 of the BACT Analysis.

12. Because HDSCR is neither “available” nor “applicable” to MRYS, this control technology is technically infeasible for MRYS.

C. Cost Effectiveness of SC

Because the Department has determined that SCR is not technically feasible, there is no need to complete the remaining steps of the top-down process. Thus, the Department declines to address the cost effectiveness of SCR for MRYS.

VI. BACT Selection

HDSCR, LDSCR and TESCR are not technically feasible. The next most effective technology is selective non-catalytic reduction (SNCR). When coupled with advanced separated overfire air (ASOFA), the expected removal efficiency is approximately 58%. BACT is represented by SNCR + ASOFA and BACT is the following limits:

Unit 1 - 0.36 lb/10^6 on a 30-day rolling average basis except during periods of startup. During startup, NO_x emissions shall not exceed 2070.2 lb/hr on a 24-hour rolling average basis.

Unit 2 - 0.35 lb/10^6 Btu on a 30-day rolling average basis except during periods of startup. During startup, NO_x emissions shall not exceed 3995.6 lb/hr on a 24-hour rolling average basis.

For purposes of this BACT determination, startup is defined as:

The period of time from initial fuel combustion to the point in time when the measured heat input to the boiler on a 6-hour rolling average is greater than or equal to 2500 x 10^6 Btu/hr for Unit 1 and 4800 x 10^6 Btu for Unit 2. For purposes of determining compliance, startup cannot exceed 61 hours for Unit 1 and 115 hours for Unit 2.

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10. ND Department of Health; Preliminary Best Available Control Technology Determination for Control of Nitrogen Oxides for M.R. Young Station Units 1 and 2; June 2008.

11. ND Department of Health; Best Available Control Technology Determination for Control of Nitrogen Oxides for M.R. Young Station Units 1 and 2; April 2010.